PD-ABW-437

Trip Report

Wes Snyder

3/13/00 to 4/1/00

Purpose:

Carry out a workshop, part 2 of 3. In this workshop, we covered management and decision aspects of the M&E context, and taught elementary statistics and SPSS use to calculate elementary statistics. The participants demonstrated their skills using artificial data, then simulation data, and finally, real QUIPS data. They reported on their interpretations of various data scenarios, and we linked their local perspectives to that of the EMIS system of their country.

Attendance:

Twenty-two field personnel and several members of the local TMG team attended the workshop. Attendance was steady with no one dropping out. Participation was enthusiastic. There was every indication that nearly everyone learned a great deal.

The initial attendance list is attached.

Plans:

Arrangements were made by TMG to provide continuous experiences over the next few months so that the skills will be further developed. In July, we shall undertake to address the concepts and issues in monitoring and evaluation. We shall provide evaluation guidelines for review and use in Ghana, a general framework to carry out evaluations, some suggestions about the parameters of national program monitoring, and then how to use evaluation for change and impact. Additional statistics skills will be covered and practiced in the context of evaluation. Presentations will be prepared by the participants.

Material Development:

The workshop covered approximately 6 hours a day over 10 days of the period. Materials were developed for the full time. This is the equivalent of 60 contact hours of university instruction. We can subtract approximately 6 hours for administration, leaving 54 hours. A university course meets 3 hours a week for about 15 weeks, which is 45 hours. Therefore, each 2 week workshop is the equivalent in time of a full 3-credit course at a university. A lot of material is required for such an undertaking. TMG has indicated that they will consider giving a certificate of attendance for the workshop series.

Examples of the lecturing material are attached.

List of Participants At The Monitoring And Evaluation Of A Simple System Workshop 2

Groups		Name	Position Held	What level do you work at (✓) National	Regional	District
One		Ms Ester Amoah -Ahinful	Assistant Director 11 (PBME)	✓		
	✓	Mr Constance Alorbu	Monitoring and Evaluation Officer (PBME)	✓		
		Mr Foster Agotse	District Monitoring Assistant			✓
		Mr James Yaw Oppong	Unit Head (Planning ,Mon. & Stats)		✓	
		Mr Emmanuel Gatugbe	Chief Inspector of Schools		✓	
	✓	Ms. Emilia M.K. Najuah	District Monitoring Assistant			✓
Two		Mr Martin Adu Frimpong	Inspector Personnel		✓	
		Mr Dan Adu Yeboah	Dist. Statistic / Planning Officer			✓
		Mr. Rapheal Agyei	Statistic Officer			✓
		Ms Leticia Effah	District Monitoring Assistant			✓
		Mr Timothy Mensah Smith	District Monitoring Assistant			✓
		Mr Johnson Boakye	Community School Alliances			
Three	✓	Mr Martin Tawiah	Monitoring and Evaluation Officer (PBME)	✓		
		Mr Callistus G. Libiedem	Inspectorate		✓	
		Mr David Hodanu	Statistic Officer		✓	
		Mr J.A. Akparibo	Statistic Officer		✓	
		Mr John Osei Awuyah	District Monitoring Assistant			✓
Four	✓	Mr Abdul Razak Umar	Monitoring and Evaluation Officer (PBME)	✓		
	✓	Mr Ben Akubia	Budgect Officer	✓		
		Mr Peter Kofi Marfo	District Monitoring Assistant			✓
		Mr Ebenezer Kofi Adu	District Monitoring Assistant			✓
		Mr John Osei	ADE, Regional Statistics Officer		✓	

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MONITORING AND EVALUATION

Presentation Notes

Professor Wes Snyder
University of Montana and the
Harvard Institute for International Development
P.O. Box 1654
Missoula, Montana 59806

March, 2000

Basis of Evaluation

Argument

Monitoring and Evaluation Workshop
March, 2000
Harvard Institute for International
Development and
University of Montana

Evaluative Questions

- M&E entails many questions:
  - Have we provided the program with resources needed? Was it implemented properly? What's going on? How well is it doing? Is it meeting its objectives? Will it really contribute to the larger goals of the education system? Why does the program work or not work?

Evaluative Questions

- Understanding
  - Why?
- Monitoring
  - What and How?
- Evaluating
  - How well and how effective?

Argument

- Not quite persuasion ...
  - Argument and persuasion have the same goals but the argument is more objective, more logical, more specific, and less motivational.

Argument

- Not quite discussion ...
  - Argument is systematic, accurate, and more precise; argument advocates some position.

Argument

Argument lies between discussion and persuasion.

...ation – Discussion – **Argument** - Persuasion

POEM

Data Collection Design

Introduction

- Worry about the *warrant.*
- Framework to guide the development of the warrant so that the work is credible and convincing.
- Evidence linked to the appropriate claim through a good 'design.'

POEM Topics

- Purpose(s)
- Obtrusiveness
- Ecology
  - Hypotheses
  - Entities
  - Local Conditions
  - Procedures
- Maturation

Purpose(s)

The Reasons

- Reason to do the study. The problem(s) to be investigated. Key concepts deemed important.
- Why are we doing the evaluation?
- What is the program and set of problems that we hope to understand?
- What relationships are of interest and what are the general implications of our evaluation?

Obtrusiveness

The Evaluator

- Your potential influence on the results (interpretive versus objective). Are the data dependent on your own observations or do you have independent checks?
- What role does the inquirer play in the observation or experience?
- What are the social and political intentions of the inquirer?

Ecology

The Context

- H = Hypotheses (claims) and specification of the variables of interest.
- E = Entities (sample size, focal attributes, representativeness, non-focal attributes).
- L = Local Situation (focal environmental variables, non-focal variables, setting event for phenomena, representativeness).
- P = Procedures (what actually happens in the conduct of the inquiry, measurements, and evaluation).

Maturation

The Time

- Sampling specification of occasions, phases, or time.
- Number of time slices and duration.
- Relation of time available and time needed for emergent phenomena.

DECIDE

- P = TQ and SA.
- O = File research; values are intrusive.
- E = TQ leads to SA, where TQ equals teacher records and SA equals exam results. Exams are high-stakes.
- M = Obtain exam results and TQ over several years.

Remember the Argument

- Claim
- Evidence
- Warrants
  - POEM
    - Conceptual design
    - Data design
  - Statistics
    - Analysis

Next Steps

- Discuss statistics.
- Understand the mean and variance.
- Carry out some exercises.
- Carry out more exercises.
- Analyze Ghana data from TMG.
- Understand relationships.
- Analyze Ghana data from TMG.

Elementary Statistics

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What's a Variable?

• 10		• 10
• 10		• 10
• 10	What's a Constant?	• 10
• 10		• 10
• 10		• 10
• 10		• 11
• 6 Values on a Scale 1		• 6 Values on Scale 2

What's a Statistic?

- A variable has difference values along the scale for the entities (persons) who attained the scores (e.g., student test scores).
- These different values form a distribution.
- A statistic describes the key characteristics of a distribution.
- A statistic has valuable properties for inference to other samples or distributions.

Statistics

- *Three concepts:*
  - Central Tendency
  - Variability
  - Covariability
- All are **averages** or **means.**
- All relate to **distributions.**

What is Research?

- *Systematic inquiry* ("worry about the warrant").
- General understanding of a phenomenon.
- Implications may or may not be immediately apparent.
- Interesting question about which there's some debate.

One Quantitative Variable

	Person	Variable 1	
	1	13	
	2	11	
Entities	3	11	Scores
	4	08	
	5	07	

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Mean

- How can we characterize the central tendency of the distribution?
- Well, what is central tendency?
- Does every value in the distribution count? What happens when we add an extreme value?
- Why would this be an interesting feature of a distribution?

Mean

• 10	• 11
• 10	• 10
• 10	• 10
• 10	• 10
• 10	• 10
• 10	• 10
• Mean?	• Mean?

Mean

• 12	• 1
• 12	• 1
• 12	• 1
• 10	• 1
• 10	• 1
• 10	• 100
• Mean?	• Mean?

Mean

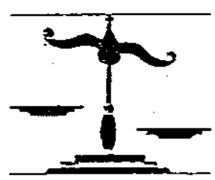
• 2	• 1
• 2	• 1
• 2	• 1
• 2	• 1
• 2	• 2
• ?	• ?
• Mean = 2	• Mean = 11

Mean

• 10		• 100
• 10	Constant	• 100
• 10	Multiplier?	• 100
• 10		• 100
• 10		• 100
• ?		• ?
• Mean = 9	⇒	• Mean = 90

Mean

- The mean is the balancing point of a distribution.
- If you add an extreme value to the distribution, the mean moves in its direction to balance the entire distribution.



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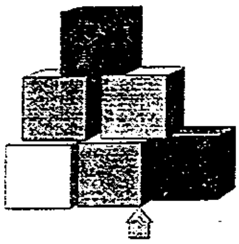
Mean

- The mean is the fulcrum.
- The mean is a key feature of a distribution. If the distribution is unimodal and symmetric, the mean lies at the center.



(unimodal but not symmetric)

Deviations from the Mean

Deviations

1	13	-10	3	
2	11	-10	1	
3	11	-10	1	
4	08	-10	?	Why?
5	07	-10	-3	

Mean

- The mean is that point on the scale where the deviations of each value in the distribution from that point sum to zero.

$$\Sigma (X_i - \mu) = 0$$

Exercises

- Meaning of the mean.
- Interpreting the mean.
- Implications of the mean.

Variability

- 10
- 10
- 10
- 10
- 10
- 10
- Variance = 0

- 11
- 10
- 10
- 10
- 10
- 10
- Variance = .167

Variability

- 12
- 12
- 12
- 10
- 10
- 10
- Variance = 1.2

- 1
- 1
- 1
- 1
- 1
- 100
- Variance = 1633.5

Variability

- 2
- 2
- 2
- 2
- 2
- 2

- Variance = 0

- 1
- 1
- 1
- 1
- 2
- 60

- Variance = 576.4

Variability

- 10
- 10
- 10
- 10
- 10
- 4

Constant

Multiplier?

- 100
- 100
- 100
- 100
- 100
- 40

- Variance = 6 ⇒ Variance = 600

Deviations from the Mean

Deviations

1	13	-10	3	
2	11	-10	1	
3	11	-10	1	
4	08	-10	-2	Why?
5	07	-10	-3	

Variations from the Mean

Variations

1	13	-10	3	9
2	11	-10	1	1
3	11	-10	1	1
4	08	-10	-2	4
5	07	-10	-3	9

$(X_i - \mu)^2 = (13 - 10)^2 = 9$

Variations from the Mean

Variations

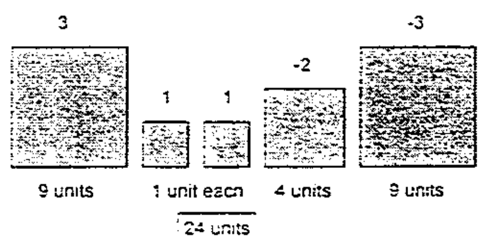
1	13	-10	3	9
2	11	-10	1	1
3	11	-10	1	1
4	08	-10	-2	4
5	07	-10	-3	9

$\Sigma (X_i - \mu)^2 = 24$ units

This is the sum of squares.

Sum of Squares

Deviations sum to zero but variations (areas) do not



Variance

Variable 1 Sum of Squares = 24 Variance = 6

Variance = Average Variation per Entity.*

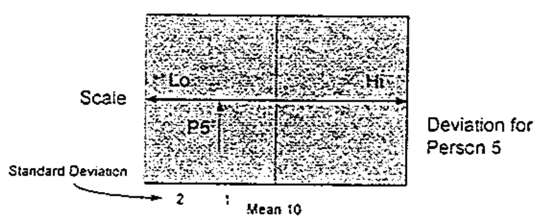
*Actually, degree of freedom, n-1

Standard Deviation

Variable 1 Variance = 6 Standard Deviation = 2.4

Standard Deviation = The linear distance from the mean the average variation per entity; that is, the square root variance—a kind of "average."

Location on a Scale



Variance

- Entities are located at different points along the scale of a variable.
- The average variation per entity is the variance.
- Variance is a "mean."
- Variance reflects the distributional spread of values for one variable; variance describes a distribution.

Mean

To demonstrate the idea of the mean of a set of data, a professor calculates the average weight of the ten students attending class that day. The mean (or average) weight of these ten students is 50kgs. Suppose that a very large student walks into class right after this mean has been calculated. If he is 70kgs. in weight, what is the mean weight of the eleven students who are now in the classroom? What happened to the mean by adding this heavy weight? If instead of a heavy student, a light student had entered, what would have happened to the mean?

Variabilitv

The composite scores on a classroom maths test have a mean of 18.5 and a standard deviation of 5.6. The composite scores on the national maths examination have a mean of 44 and a standard deviation of 11 in the same year.

Suppose you have a student who scored at the 97.7 percentile on the classroom maths test. Interpret this statement.

Suppose one student had a 25 on the classroom maths test and another 53 on the national maths examination. Which student has the higher score relative to their individual tests. Why?

z-scores

Most students wonder how their test scores compare to those of the rest of the class. Suppose that you and five friends are taking a Research and Statistics course, and the six of you received the following grades: 80, 70, 75, 90, 100, 85. The instructor tells the class that the mean and standard deviation for all the test scores are 85 and 5, respectively. Calculate the z-score for each of the six test scores. State whether each of the test scores lies above or below the mean and by how many standard deviations. Do you think any of these test scores is the highest or the lowest in the class?

Two Quantitative Variables

	Person	Variable 1		Variable 2
	1	13		60
	2	11		52
Entities	3	11	Scores	52
	4	08		46
	5	07		40

Deviations from Each Mean

			Deviations			Deviations
1	13	-10	3	60	-50	10
2	11	-10	1	52	-50	2
3	11	-10	1	52	-50	2
4	08	-10	-2	46	-50	-4
5	07	-10	[illegible]	40	-50	[illegible]

Variations from Each Mean

				Variations				Variations
1	13	-10	3	9	60	-50	10	100
2	11	-10	1	1	52	-50	2	4
3	11	-10	1	1	52	-50	2	4
4	08	-10	-2	4	46	-50	-4	16
5	07	-10	-3	9	40	-50	-10	100

Variances

Variable 1 Sum of Squares = 24 Variance = 6

Variable 2 Sum of Squares = 224 Variance = 56

Variance = Average Variation per Entity*

Recall, that this is the entities free to vary, of

Standard Deviations

Variable 1 Variance = 6 Standard Deviation = 2.4

Variable 2 Variance = 56 Standard Deviation = 7.5

Standard Deviation = The linear distance from the mean the average variation per entity; that is, the square root variance—a kind of "average"

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Exercises

- Understanding variability.
- Interpreting variance.
- Implications of variance.

Describing Two Variables

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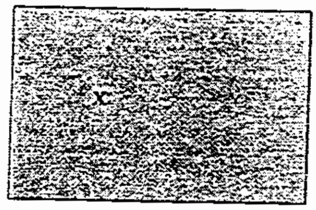
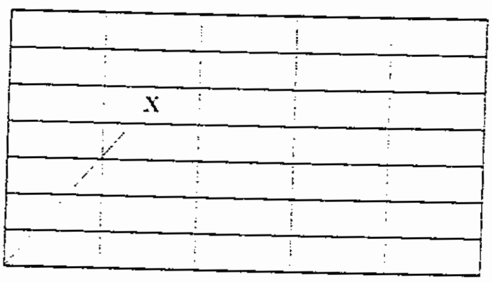
2-Dimensions

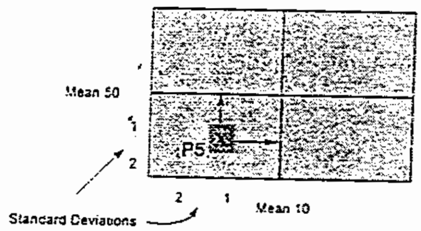
How do we locate the X in the space?



2-Dimensions



Location in Joint Space



Deviations for Person 5

Covariation

								Covariations
1	13	-10	3	60	-50	10		30
2	11	-10	1	52	-50	2		2
3	11	-10	1	52	-50	2		2
4	08	-10	-2	46	-50	-4		8
5	07	-10	-3	40	-50	-10		30

Covariation

- Covariation takes into account the deviations from each of the means.
- Covariation is linked by the entity that is common to the two deviations.
- Covariation is an area bounded by the deviations.
- Covariation locates the entity in the joint space of the two quantitative variables.

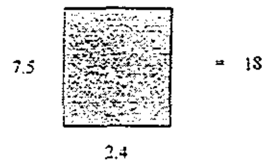
Covariance

- Covariance is a mean.
- Covariance reflects the relationship between the variabilities for two quantitative variables.
- Covariance retains the original scales and can only be reasonably interpreted in terms of those scales—for example, what does 18 mean?

Look at the two SDs! (2.4x7.5)

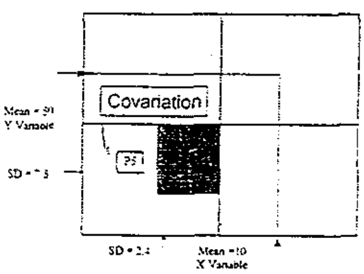
Covariance

Covariance is an area bounded by the two SDs.

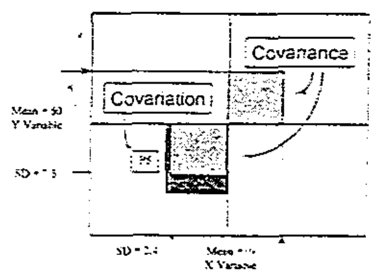


Note: In regression terms we lose one degree of freedom. If we use a simple average, then Covariance = 14.4 and it doesn't display this relationship clearly

Covariation



Covariation and Covariance



Variance and Covariance

- Entities are located at different points along the scale of a variable.
- The average variation per entity is the variance.
- Entities are located at different points in the joint space of the scales of two variables.
- The average covariation per entity is the covariance.

Variance and Covariance

- Both variance and covariance are means.
- Variance reflects the distributional spread of values for one variable.
- Covariance reflects the shared distributional spread of values for two variables.

Locating an Individual

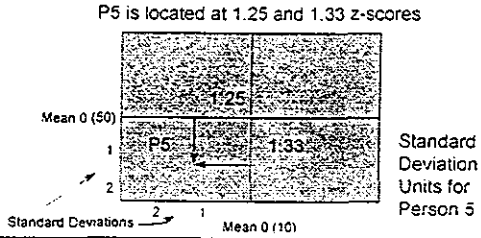
- To locate a particular entity in the distribution of one variable, we looked to the z-score value to provide meaning—the individual deviation was compared to a "standard" deviation and we were thus to translate the z-score in terms of standard deviation units.

Joint Space Location

- In the joint space, the individual has two z-scores, one for each variable.
- The z-score transformation brings the raw scores of the two variables to a scale that reflects the standard deviation units of the two variables.
- We can now locate the individual in a standardized joint space.

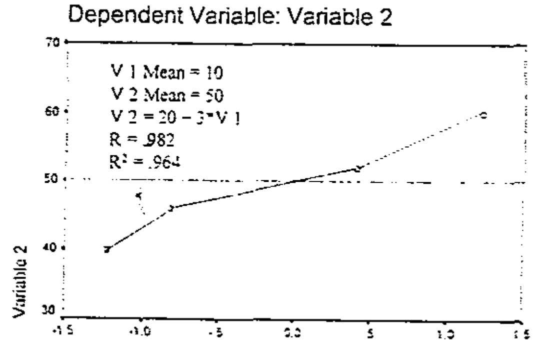
Location in Joint Space

P5 is located at 1.25 and 1.33 z-scores



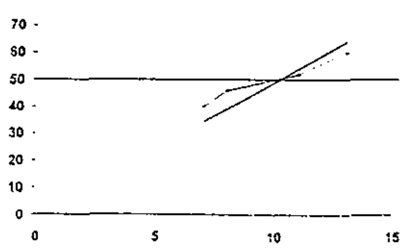
Scatterplot

Dependent Variable: Variable 2



Regression Standardized Predicted Value

Scatterplot of 5 Entities



Covariance

- The values for the two variables are almost arranged in a straight line.
- The two scales are different in size: the X (horizontal) is the smaller, ranging from 7-13 (6 units), whereas the Y (vertical) ranges from 40-60 (20 units).
- The information in X tells us the rank position of the entity in Y: scale differences account for change in slope.

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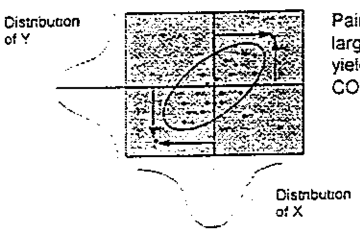
Large/Positive Covariance

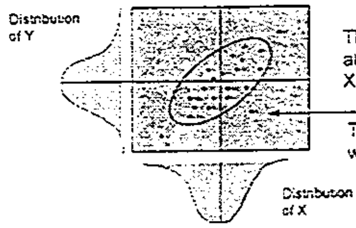
n = 20



Paired large positive or large negative deviations yield large positive COVARIANCE

Individual Influence on Covariance

n = 20

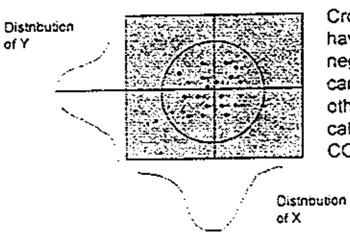


This entity is above the mean on X and below on Y

The covariation will be negative

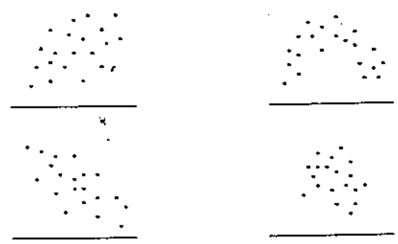
Covariance ⇨ Zero

n = 20



Cross-products have positive and negative signs, thus cancelling each other in the calculation of COVARIANCE

Scatterplots



Scale in Covariance

Covariance depends on the units of measurement underlying the X and Y variables. For example, if we used centimeters instead of inches to measure height for variable X, the each ($X - \bar{X}$) in centimeters would be 2.54 times as large as it would be in inches.

Average Height

$(X - \bar{X})$ = (72 inches - 67) = 5 inches

= (183 cm - 170) = 13 cm

Scale in Covariance

Weight offers the same kinds of choices. In English measures, we use pounds. In metric, we use kilograms, and each kilogram is 2.2 pounds. But when someone asks, "How closely related are height and weight in some sample?" she does not want the answer to depend upon the choice of English or metric units of measurement. The answer may be more meaningful in this case if *dimensionless.*

Remember Standard Scores ⇨ z-scores

Large/Positive Covariance

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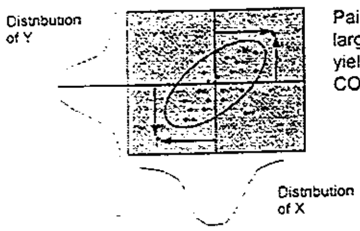

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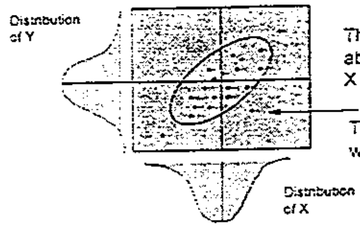
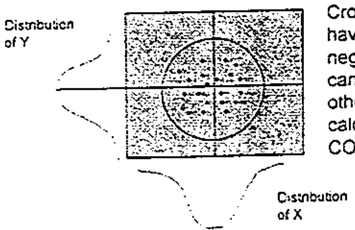


This entity is above the mean on X and below on Y

The covariation will be negative

Covariance ⇨ Zero

n = 20



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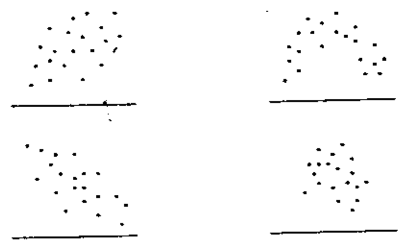

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Location in Joint Space

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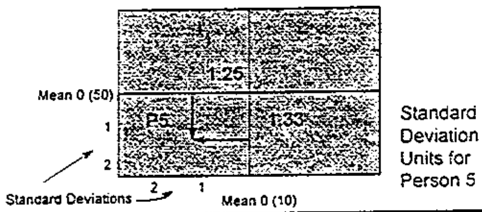

Relationship

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Sir Francis Galton

- First cousin of Darwin (13 years older). Galton (1822-1911).
- Early visitor to Namibia (1850-1852). Went up as far as Etosha. Received gold medal from the RGS. Timing: *The Origin of Species* (Darwin) published in 1859.
- Galton was an eugenist -- most relevant and important variables in human affairs are inherited. Medical training.

Early Deviations

- As early as the 1700s the usefulness of a measure that reflects the dispersion of the range of possible scores in a distribution had been recognized, e.g. De Moivre and the *modulus* (semi-interquartile range; difference of 75th percentile and 25th, divided by 2).
- Karl Pearson in 1894 first used the term standard deviation and gave it the symbol sigma, s. It corresponds to the point on the curve of a normal distribution that represents the *point of inflection*, where the curvature changes from concave to convex.
- Francis Galton was a collector of data. About 1875 he began weighing and measuring the diameters of thousands of sweet pea seeds. He took samples of 10 seeds and sent them all over Britain. Results reported in 1877.

Seeds of Regression

- Offsprings of seeds had normally distributed weights and the deviations across samples were roughly the same. Large parents had larger than average seeds but the mean was not quite as large as the parental weight.
- Called *Reversion*.

Reversion = r

- "By family variability is meant the departure of the children of the same or similarly descended families, from the ideal mean type of all of them. Reversion is the tendency of that ideal mean filial type to depart from the parent type, "reverting" towards what may be roughly and perhaps fairly described as the average ancestral type. If family variability had been the only process in simple descent that affected the characteristics of a sample, the dispersion of the race from its mean *ideal* type *would* indefinitely increase with the number of generations; but reversion checks this increase, and brings it to a standstill." (Galton, 1877).

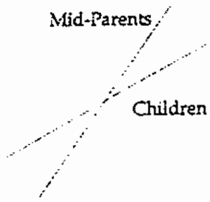
Human Regression

- Unlike seeds, humans had two parents, so Galton took the mid-parent, the average of the parents' height with the female height scaled by 1.08.
- Set up an anthropometric center where, for a fee, people were measured.
- By 1885, he had 928 children born of 205 mid-parents.

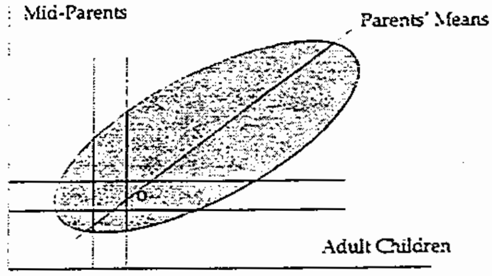
20

Regression

- Dataset presented columns of data, each column with a mean and variance for the children.
- The same was true for the rows for the parents.
- Regression!



Regression



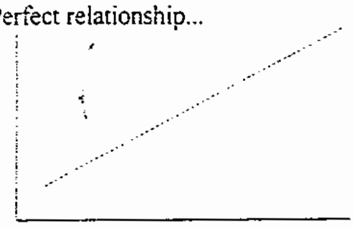
Waiting for a Train

Find the Medians

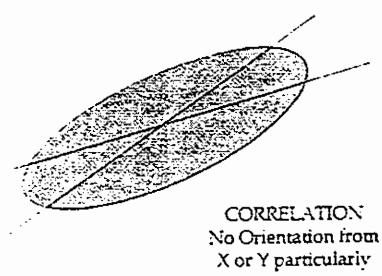
x x x
x x x x
x x x x x
x x x x
x x

Any Regression?

- Perfect relationship...



Mean of Regressions



Co-relation

- 1888, Galton wrote *Co-relations and Their Measurement*
- "Let y = the deviation of the subject whichever of the two variables may be taken in that capacity; and let x_1, x_2, x_3, etc., be the corresponding deviations of the relative, and let the mean of these be X. Then we find (1) that $y = rX$ for all values of y; (2) that *r* is the same whichever of the two variables is taken for the subject; (3) that *r* is always less than 1; (4) that *r* measures the closeness of co-relation." (Galton, 1888)

Pearson's Product Moment

- Moment is a deviation around the center of gravity.
- $\Sigma xy/n$ = Covariance, where x and y are moments around their respective means (hence product moment).
- Correlation takes into account the two scales of the variables, $\Sigma xy/ns_X s_Y = r$.
- Correlation is a mean (covariance)! and is a mean (of regression lines)!

One Group

- Central Tendency - the balancing point of the distribution; where the group is located, in general, on the scale of the focal variable.
- *Variance - the variability around the* balancing point; how the group is spread across the scale of the focal variable.

One Group on One Variable

- 1
- 2
- 3 Mean = 3; SD = 1.41
- 4
- 5

One Group on Two Variables

• 1	7	
• 2	9	
• 3	11	$Mean_2$ = 11; SD_2 = 2.82
• 4	13	
• 5	15	

Covariation (Relationship)

- Variable 1: Mean and SD; Variance.
- Covariance: Product of deviations from each mean averaged.
- Correlation: Standardized Covariance.
- Variable 2: Mean and SD; Variance.

Covariance and Correlation

• 1	7	z-crossprod=	2.0
• 2	9		0.5
• 3	11		0.0
• 4	13		0.5
• 5	15		2.0

One Categorical; One Metric

• 1	7	*Two Groups:*
• 1	9	
• 1	11	The one group can be
• 2	13	split into two groups
• 2	15	based on the first variable.

Relationships

• 1	7	Correlation: low-low or
• 1	9	high-high or low-high etc.
• 1	11	
• 2	13	One and two not a scale.
• 2	15	So, look at difference.

Difference = Deviation

• 1	7	Look at Mean for Metric
• 1	9	Variable = 11, remember?
• 1	11	
• 2	13	Now look at groups: "1"
• 2	15	Mean = 9; "2" = 14.

t-test (Relationship: C,M)

- Thus, we have the start of the t-test:
- $(\text{Mean}_1\text{-Mean})\text{-}(\text{Mean}_2\text{-Mean})=M_1\text{-}M_2$.
- Then we look for the variance of the difference; the square root is the standard deviation = called "standard error."
- Another way to look for relationship!

Analysis of Variance (C,M)

• 1	7	Now three groups or more.
• 1	9	Same logic applies:
• 2	11	We look for mean
• 2	13	differences!
• 3	15	
• 3	17	

Same Mean for All Groups

- If all the distributions fall at the same balancing point (mean) on the scale of the metric variable, the total distribution is unimodal -- one peak.
- The means of the categories are then the same as the overall mean.

Different Means for Groups

- If the means of the categories are different, then the total distribution is multi-modal (many peaks, one for each group, reflecting the central tendencies of each group).
- What has happened to the overall variance? Thus, the analysis of variance!

TRIP REPORT for Conrad Wesley Snyder, Jr.

Ghana QUIPS/PME Project
Harvard Institute for International Development
November, 1999

1. Searched the internet and libraries for references on monitoring and evaluation. Talked to the Mid-Continent Regional Education Laboratory about their reference lists for both instruction and evaluation. Got materials from McREL and brought them to Ghana. Assembled a reference list and selected key references for M&E. Ordered a sample of the books from the reference list for TMG.
2. Reviewed materials on evaluation training.
3. Developed a training manual (Volume 1) for M&E with inputs from Tom Welsh, Elizabeth Barcikowski, Rebecca Corn, and George Woode. Worked with George Woode in all phases of the training workshop development.
4. Edited and had printed the workshop materials.
5. Assembled materials for simulated database on a country, called DECIDE. Ms. Corn developed the Access database working with TMG personnel.
6. Ran the workshop for Ministry personnel who are involved or connected with the Division of Planning, Budgeting, Monitoring, and Evaluation. Continued contact and consultation with Patrick Yiriyelleh on the training requirements. The workshop was run over two weeks at the La Palm Hotel in Accra, Ghana, and attendance remained steady and high throughout the sessions. Tom Welsh and Becky Corn helped in various phases of the workshop.
7. Worked with individual personnel on difficulties arising from the workshop work. Briefed Patrick Yiriyelleh on progress and plans.

The first two workshops are intended to provide the elementary foundations for M&E in simple education systems. Workshop 1 focused on the development of problem statements and the constituent components of M&E. Workshop 2 will focus on setting up the context information for M&E, and the use of statistics to analyze the relevant achievement information. We shall then introduce the notion of complexity. Workshops 3 and 4 (if continued) would proceed to address M&E in complex systems. This entails using the simple system information and elaborating it with multiple stakeholders, using the argumentative procedures associated with assumption surfacing and policy analysis. We shall conclude by taking up some 'real' policy issues, building on the 'policy brief' activities introduced in the EMIS project.

Specific Product: *Monitoring and Evaluation: Volume 1: Training Manual, M&E of a Simple System.*